

## The Properties of Brightest Cluster Galaxies in X-Ray Selected Clusters

Sarah Brough

*Astrophysics Research Institute, Liverpool John Moores University,  
 England.*

Chris A. Collins

*Astrophysics Research Institute, Liverpool John Moores University,  
 England.*

Doug J. Burke

*Harvard-Smithsonian Center for Astrophysics, Cambridge, USA.*

Paul D. Lynam

*Max-Planck-Institut fur Extraterrestrische Physik, Garching, Germany.*

Robert G. Mann

*Institute for Astronomy, University of Edinburgh, Edinburgh, England.*

**Abstract.** We present the K-band Hubble diagram for 162 brightest cluster galaxies (BCGs) in X-ray selected clusters,  $0.01 < z < 0.83$ . The sample incorporates that of Burke, Collins, & Mann (2000) and includes additional infrared data from the 2MASS extended source catalogue. We show that below  $z \sim 0.1$  the BCGs show no correlation with their environment, however, above  $z \sim 0.1$  BCGs in more X-ray luminous clusters are more uniform in their photometric properties. This suggests that there may be two populations of BCGs which have different evolutionary histories.

### 1. Introduction

Brightest cluster galaxies (BCGs) provide a unique sample with which to study galaxy evolution in a cluster environment. In a sample of 78 BCGs,  $0.05 < z < 0.8$ , in X-ray selected clusters, Collins & Mann (1998) and Burke, Collins, & Mann (2000) observed a split with cluster properties in their K-band Hubble diagram. This work substantially increases their sample with 84 BCGs below  $z \sim 0.1$  from the *ROSAT* All Sky Survey, with  $K_s$ -band data from the 2MASS catalogue. The colour correction between the 2MASS  $K_s$ -band and the K-band is negligible (Carpenter 2001) and is henceforth neglected. The 2MASS magnitudes have been checked for consistency against data from the 2m UH telescope. A full discussion of this work will be presented in Brough et al., in preparation.

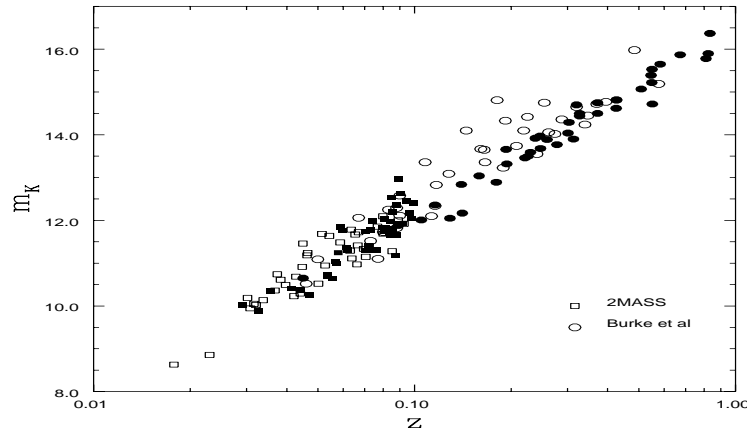


Figure 1. The Hubble diagram. The filled points denote BCGs in clusters with  $L_X(0.3 - 3.5\text{keV}) > 2.3 \times 10^{44}\text{ergs}^{-1}$

## 2. Results and Conclusions

Fig. 1 shows the K-band Hubble diagram for 162 BCGs. At redshifts beyond  $z > 0.1$  BCG magnitudes depend on the X-ray luminosity of the host environment, as suggested by Collins & Mann (1998). In particular, clusters with  $L_X(0.3 - 3.5\text{keV}) > 2.3 \times 10^{44}\text{ergs}^{-1}$  have a scatter of 0.24 mag, compared to those in the low luminosity clusters which have an rms dispersion of 0.5 mag and a Kolmogorov-Smirnov test shows that BCGs in the different environments are different at  $> 99.9$  per cent significance. However, the 97 clusters below  $z=0.1$  indicate that locally BCG magnitudes have a dispersion of 0.3 mag and are uncorrelated with the X-ray luminosity of their host cluster. A KS test shows that they are drawn from the same population at 90 per cent level. These differences suggest that there may be two populations of BCGs with different evolutionary histories: BCGs in less X-ray luminous clusters evolving through a process of mergers and those in more luminous clusters evolving passively. This result has also been seen by Zaritsky et al. in this meeting (astro-ph/0108152).

## Acknowledgments

This publication makes use of data products from 2MASS which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation.

## References

- Brough, S. Burke, D.J. Collins, C.A. Lynam, P.D. Mann, R.G. 2001, in prep.
- Burke, D.J. Collins, C.A. Mann, R.G. 2000, ApJ, 532, L105
- Carpenter, J.M. 2001, AJ, 121, 2851
- Collins, C.A. Mann, R.G. 1998, MNRAS, 297, 128